Clinical Effects of an Amino Acid and Glucose Solution in Non-surgical Gastrointestinal Patients of Internal Medicine

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ABSTRACT

***Background**: This study was performed to assess the efficacy and safety of intravenous amino acid and glucose solution with electrolytes in non-surgical gastrointestinal patients.*

***Method**: This single, open, and pre-post study was conducted in the internal medicine ward at Cipto Mangunkusumo hospital between June 2007 and March 2008. Patients were administered solution of amino acid, glucose, and electrolytes via peripheral vein at a dose of 1000 mL/day for one week period. Non-operative gastroenterology patients with age between 16 and 65 years were eligible in this study; patients were excluded if they had diabetes mellitus, severe hepatic or renal dysfunction, electrolyte disturbance, and obesity. The data were analyzed by paired t-test and McNemar test using SPSS version 16.*

***Results**: Fifteen patients consisted of 8 (53.5%) female, mean age was 38.47 ± 14.73 years. The body mass index (BMI) at screening was 14.50 ± 2.11 kg/m^2. Patients' BMI increased in day-1, day-3, and day-7 into 14.5; 14.58; 14.80 kg/m^2, respectively ($p < 0.05$). The increasing of prealbumin, albumin, transferin, and total protein were 7.30 mg/dL vs 11.16 mg/dL; $p = 0.018$; 2.71 g/dL vs 3.12 g/dL; $p = 0.024$; 102.37 mg/dL vs 141.95 mg/dL; $p = 0.016$; 6.24 g/dL vs 6.85 g/dL; $p = 0.019$, respectively. The clinical symptoms of nausea and weakness in patients decreased from 53.3% to 6.7%; $p = 0.016$, and 66.7% to 6.7%; $p = 0.004$.*

***Conclusion**: This parenteral nutrition solution was effective to improve clinical nutrition parameters.*

***Keywords**: amino acid and glucose solution, non-surgical gastrointestinal patients, peripheral parenteral nutrition*

ABSTRAK

***Latar belakang**: Penelitian ini bertujuan menilai efektivitas suatu larutan asam amino dan glukosa dengan elektrolit intravena pada pasien gastrointestinal non-bedah.*

***Metode**: Studi tunggal, terbuka, dan pre-post ini dilakukan di ruang rawat penyakit dalam Rumah Sakit Cipto Mangunkusumo pada bulan Juni 2007 hingga Maret 2008. Kepada pasien diberikan larutan asam amino, glukosa dan elektrolit, melalui akses vena perifer dengan dosis 1000 mL/hari selama periode satu minggu. Pasien gastrointestinal non-bedah dengan usia antara 16-65 tahun memenuhi syarat diikutsertakan penelitian ini; pasien dengan diabetes melitus, disfungsi berat hati dan ginjal, gangguan elektrolit dan obesitas tidak dapat diikutsertakan dalam penelitian ini. Data dianalisis menggunakan uji T berpasangan dan McNemar dengan SPSS versi 16.*

***Hasil**: Sejumlah 15 pasien yang terdiri dari 8 pasien (53,3%) perempuan dan rata-rata usia pasien sebesar 38,47 ± 14,73 tahun. Indeks massa tubuh (IMT) pada penyaringan sebesar 14,50 ± 2,11 kg/m^2. Pada pasien terjadi peningkatan IMT pada hari ke-1, hari ke-3, dan hari ke-7 secara berurutan sebesar 14,5; 14,58; 14,80 kg/m^2 ($p < 0,05$). Peningkatan prealbumin, albumin, transferin, dan protein total secara berurutan sebesar 7,29 mg/dL vs 11,16 mg/dL; $p = 0,018$;*

2,71 g/dL vs 3,12 g/dL; p = 0.024; 102,37 mg/dL vs 141,95 mg/dL; p = 0,016; 6,24 g/dL vs 6,85 g/dL; p = 0,019. Gejala klinis mual pada pasien berkurang dari 53,3% menjadi 6,7%; p = 0,016, begitu halnya kelemahan tubuh pasien dari 66,7% menjadi 6,7%; p = 0,004.

***Kesimpulan**: Larutan nutrisi parenteral efektif dalam meningkatkan parameter nutrisi klinis.*

***Kata kunci**: larutan asam amino dan glukosa, pasien gastrointestinal non-bedah, nutrisi parenteral perifer*

INTRODUCTION

Parenteral nutrition prevents the adverse effects of malnutrition in patients who are unable to obtain adequate nutrients by oral or enteral routes.[1] This becomes one of the most important therapeutic modalities in the management of patients who have been admitted to internal medicine department, especially gastrointestinal disease patients with clinical symptoms such as nausea, vomiting, dry mouth, bloating that lead to feeding difficulty. Those patients are at increased risk for developing nutritional abnormalities because of alterations in nutrient intake, decrease in nutrient digestion and absorbsion, and increase nutrient lost.[2]

Parenteral nutrition solution can be divided into two types: (a) central parenteral nutrition, also refers as total parenteral nutrition (TPN), and (b) peripheral parenteral nutrition, also refers as partial parenteral nutrition (PPN). Patients receiving TPN must be closely monitored to minimize risk of infection and complications such as pneumothorax or hemothorax. Compared with TPN, PPN become much safer and simpler method of nutrition compliance.[3,4] However, many clinicians argue about not using PPN because it is a short-term therapy with minimal impact on nutritional status.[3,5] The nutritional management using PPN has not been extensively studied because concentrated intravenous nutrition solutions cannot be tolerated by peripheral veins due to their high osmolarity. In daily practice, many clinicians also support that PPN can be used as supplemental feeding or in a transitional phase to enteral feeding. In some cases, inappropriate use may result in infusion phlebitis or inadequate nutrient intake.[6,7,8]

Amino acid and glucose solution consist of 3% of amino acids and 7.5% of glucose with electrolytes (sodium, potassium, chlorine, calcium, magnesium, phosphorus, and zinc) for peripheral venous administration. Amino acid and glucose solution is a PPN solution that can serve as both nutritional solution and a maintenance solution. The general objective of this study was to assess the efficacy and safety of amino acid and glucose solution, an intravenous amino acid and glucose solution with electrolytes, in non surgical gastrointestinal patients in internal medicine ward.

METHOD

This study was single, open, and pre-post study, conducted in the internal medicine ward at Cipto Mangunkusumo Hospital between June 2007 and March 2008. Written informed consent was obtained from patients who participated in the study. Patients eligible for the study were between 16 and 65 years old and belonged to non-operative gastroenterology patients. Other inclusion criteria includes patients unable to receive oral intake or enteral nutrition adequately for 7 days and not able/sufficient to receive daily nutrition by oral/ enteral administration. Exclusion criteria were on-going diabetes mellitus, severe hepatic or renal dysfunction, and electrolyte disturbance, such as hypercalcemia, hypermagnesemia, or hyperphosphatemia. The remaining exclusion criteria was body weight greater than 130% of ideal body weight (obesity).

We assessed and classified patients into 4 groups, that are consisted of completed case referred to patients who had completed with all performed study requirements and examinations; ineligible case referred to patients with exclusion criteria; discontinued case referred to patients who were requested to discontinue as study participant, based on the investigator's judgement or due to drug effects; dropout case referred to patient who failed to complete the study period. All the non-surgical gastrointestinal patients, admitted in internal medicine ward at Cipto Mangunkusumo hospital and already fulfilled the inclusion and exclusion criterias, were enrolled in this study. To the patients, amino acid and glucose solution were administered via peripheral vein at a dose of 1000 mL daily for 1 week (7 days) period. During the days of treatment, clinical observations and laboratory examinations were performed.

We observed the clinical signs and symptoms, such as nausea, vomiting, dry mouth, weakness, dehydration, edema and physical examinations consisting of body weight, height, bood preassure, body temperature, pulse rate before the study, as daily examinations, day-3, and day-7. The hematology parameters, consisted of red blood cell, white blood cell, hemoglobin, hematocrit, platelet count, and

blood chemistry parameters, consisted of aspartate transaminase (AST), alanine aminotransferase (ALT), albumin, pre-albumin, transferrin, total protein, electrolytes (sodium, potassium, chlorine, calcium, magnesium), blood urea nitrogen, creatinine, and blood glucose were also observed. AST and ALT were measured before initiation of the study. Furthermore urinalysis parameters such as volume, osmolarity, and total nitrogen were observed during the study. The concomitant use of agents (solution) other than amino acid and glucose solution that might affect the result of this study was prohibited.

The data were processed and analysed by using SPSS version 16. Laboratory measurements were assessed by paired T-test to compare the mean number of hemoglobin, white blood count, red blood count, platelet count, urea nitrogen, creatinine, albumin level, sodium, potassium, chloride, calcium, and magnesium at screening and at the end of study. In addition, paired T-test was also used to measure the alteration of body mass index (BMI). By using McNemar test, the clinical symptoms before and after treatment were investigated in each group. Probabilities value < 0.05 will was accepted as significant.

RESULTS

Among 485 non-surgical gastrointestinal patients in internal medicine ward at Cipto Mangunkusumo hospital, 15 patients were eligible for this study. These patients, consisted of 8 (53.5%) female with range age and body mass index (BMI) as shown in Table 1. The laboratory measurements at baseline were hemoglobin, white blood count, red blood count, platelet, urea nitrogen, creatinine, random blood sugar, ALT, AST, albumin, sodium, potassium, calcium and magnesium.

Table 1. Summary of demographic and baseline characteristics

Variable	Mean ± SD
Sex (%)	
Male	7 (46.7)
Female	8 (53.5)
Age (years)	38.48 ± 14.73
Body weight (kg)	36.67 ± 6.26
Body height (cm)	158.87 ± 8.57
Body mass index (kg/m^2)	14.50 ± 2.11

As shown in Figure 1, the body mass index increased from day -1 until day-7, a highly significant difference. The clinical signs and symptoms were improved during supplementation of the study, nausea and weakness showed statistically significant (Table 2).

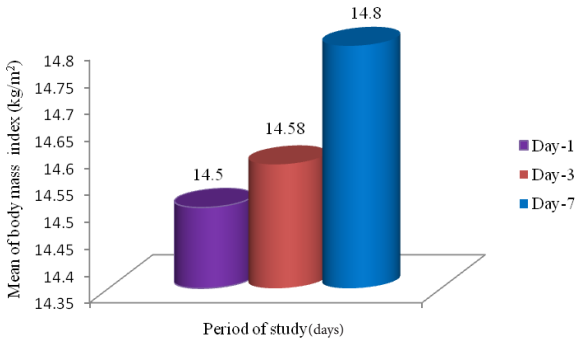

Figure 1. Significant increase of mean of body mass index

Table 2. The distribution of clinical symptom

Variable	At screening	At the end of study	p
	n (%)	n (%)	
Clinical symptoms			
Dry mouth	3 (20.0)	1 (6.7)	0.625
Nausea	8 (53.3)	1 (6.7)	0.016*
Vomiting	0 (0)	0 (0)	--
Bloating	1 (6.7)	0 (0)	1.000
Diarrhea	2 (13.3)	0 (0)	0.500
Weakness	10 (66.7)	1 (6.7)	0.004*
Dehydration	1 (6.7)	0 (0)	1.000

* p < 0.05 showed statistically difference between clinical symptom before and after therapy by McNemar test

The laboratory parameters of nutritional status showed us that the mean of prealbumin, albumin, transferin, and total protein showed statistically significant increase, while volume nitrogen and total nitrogen showed no significance difference (Table 3).

Table 3. The distribution of nutritional status

Variable	At screening	At the end of study	p
Body mass index (kg/m^2)	14.50	14.80	0.0001*
Nutritional status	7.30	11.16	0.018*
Prealbumin (mg/dL)	2.71	3.12	0.024*
Albumin (g/dL)	102.34	141.95	0.016*
Transferrin (mg/dL)	6.24	6.85	0.019*
Total protein (g/dL)	1,790.0	1,645.0	0.778
Volume (cc)	4.63	4.68	0.789
Total nitrogen (g/day)			

* p < 0.05 showed statistically difference between mean of nutritional status before and after therapy by paired T test

Table 4. The distribution of laboratory assessment

Laboratory assessment	At screening	At the end of study	p
Hemoglobin (g/dL)	10.30	10.40	0.798
WBC (/µL)	9.06	8.45	0.594
RBC (/µ)	3.87	3.78	0.478
Platelet (/µL)	430.07	476.67	0.798
BUN (mg/dL)	8.87	12.47	0.069
Creatinine (mg/dL)	0.47	0.49	0.680
Sodium (mmol/L)	134.60	132.13	0.285
Potassium (mmol/L)	3.43	4.02	0.009*
Chloride (mmol/L)	98.47	91.01	0.283
Calcium (mg/dL)	7.30	8.10	0.017*
Magnesium (mg/dL)	1.73	1.81	0.417

*p < 0.05 showed statistically difference between mean of laboratory assessment before and after therapy by paired T test; WBC: white blood cell; RBC: red blood cell; BUN: blood urea nitrogen

Table 4 showed statistically significant increase in laboratory assessment of potassium and calcium during infusion of amino acid solution between screening and at the end of the study. The others laboratory parameters: hemoglobin, red blood cell, platelet, blood urea nitrogen, creatinine, magnesium have no difference such it seen to be increased.

DISCUSSION

TPN has completely changed the medical and surgical management of patient with contraindication for enteral nutrition such as intestinal insufficiency and failure. It is used when it proves impossible to provide adequate nutrition by the gastrointestinal route. Long term TPN is now possible to improve the quality of patient.

The use of TPN can involve some difficulties and lead to some complications. Typically TPN is delivered through a vein with sufficient flow to allow the infusion of hypertonic solution without risking phlebitis. The insertion and placement of central venous catheters is associated with morbidity and mortality and is the main cause of TPN-related complications. Access to these central vein may lead to serious complication.[9] There are some complications of central catheters for parenteral nutrition, such as: mechanical complications related to central catheter placement, arterial puncture, pneumothorax, air embolism, catheter sepsis, central vein thrombophlebitis, and pulmonary thromboembolism.

Peripheral parenteral nutrition (PPN) is an alternative to TPN that has been used for several decades. When PPN is used in appropriate patient, PPN is as effective as TPN in improving physiologic function. Moreover it diminishes many complications that are caused by TPN and is less expensive. PPN is applied to the intravenous administration of nutrients without specifying the formulation as long as the osmolarity remains within limits of tolerance of peripheral veins (800-900 mOsm/L).[10]

In this study, amino acid and glucose solution was used as a peripheral parenteral nutrition. It is effective because it can serve as both nutritional and maintenance solution. Generally, nutrition solutions are complex formulations that contains energy, supplied as dextrose, protein, electrolytes, trace elements, vitamin and water.

The amino acid and glucose solution as parenteral nutrition consists of 2 chambers: the upper chamber contains protein solution and the lower chamber contains glucose and electrolytes. So as the parenteral nutrition amino acid and glucose solution being used in this study, also has a complex formulation with different types of solutions of amino acids, carbohydrates, trace elements, vitamin and electrolytes. Amino acid and glucose solution has 7.5% dextrose and 30 g amino acid/1000 cc. The parenteral nutrition components usually need to be individualized for patients according to their primary diagnosis, chronic diseases, fluid and electrolyte balance, acid base status and specific goals of parenteral nutrition.

In this study we have investigated the clinical usefulness of amino acid and glucose solution in non-surgical gastrointestinal patients admitted to internal medicine department. Furthermore, physical examination, anthropometric measurement and laboratory data were used to monitor the efficacy of intervention. BMI is one of indicators to evaluate the effectiveness of the nutritional support. In this study we can see there was significant increase of BMI after intervention. After supplementation of amino acid and glucose solution 1,000 mL daily for one week, the mean of BMI increased from 14.50 to 14.58 kg/m^2 in day-3 and finally increased to 14.80 kg/m^2 in day-7. This data showed that this solution could be effective to increase BMI.

Beside anthropometric parameter, nutrition-specific laboratory data can be defined as nutritional status information. We evaluated some laboratory data, such as: total protein, albumin, transferin and prealbumin in this study to measure the protein status as those substances have vary half-lifes. The study demonstrated that amino acid and glucose solution was effective in improving those parameters. The albumin level increased significantly from 2.71 to 3.12 g/dL. The other laboratory parameters (prealbumin, transferin and total protein) also increase significantly after intervention. Albumin is a negative acute-phase reactant and has the longest half life (18-20 days) compared to prealbumin (8-9 days) and transferin (2-3 days). It has been the most extensively used for assesing overall nutritional status, whereas serum transferin reflects protein status over the past two to four weeks and prealbumin over the past days to week.[11] Although patients just received one week intervention, this study already showed the improvement of total protein, albumin, transferrin, and prealbumin level that evaluate nutritional status. Further study are needed to prove that.

Parenteral nutrition has a role in the treatment of acute or chronic intestinal failure. Intestinal failure is characterized by reduced intestinal absorption

of macronutrient and/or water and electrolytes that are needed to maintain health and/or growth, such as in condition with severe gut dysfunction due to prolonged ileus, obstruction, or severe hemorrhagic pancreatitis.[12] But in this study parenteral nutrition is used as a supplementation so this solution was used for so a lot of cases.

Parenteral nutrition solutions are complex formulations that include caloric supplied as dextrose and fat as well as protein, electrolytes, trace elements, vitamins and water. The amino acid in this solution is optimized for protein synthesis. The amino acid in this solution also has standard amino acid formulation.[13] In general, standard amino acid products are used for patient with normal organ function and normal nutritional needs. In this study we excluded patients who had diabetes mellitus, severe hepatic or renal dysfunction, hyperkalemia, hypercalcemia, hypermagnesemia, or hyperphosphatemia. We also excluded patients with body weight greater than 130% of ideal body weight (obesity). The amino acid and glucose solution has high content of essentials of amino acid and higher content of brain chain amino acid around 30%.

Safety issues related to parenteral nutrition formulations have led into the development of guidelines for a safe practice. The specific issues are infection control and nutrition stability. When administering parenteral nutrition, special care must be taken to prevent and detect complications. Maintaining asepsis is one of the most important issues in parenteral nutrition therapy as feeding catheter related infections can be life threatening.[13]

CONCLUSION

The potential beneficial role of amino acid and glucose solution are showed in order to increase the nutritional status. The study demonstrated a significant increase in prealbumin, albumin, transferrin and total protein as the parameters of nutritional status. Laboratory assessments, such as potassium and calcium also increased significantly, whereas haemoglobin, platelet, urea nitrogen, creatinine, and magnesium improved although not significant. The amino acid and glucose solution was useful to improve the clinical symptoms, such as nausea and weakness significantly, while dry mouth, bloating, diarrhea and dehydration improved although not significant. Amino acid and glucose solution is effective to be administered in non surgical gastrointestinal patients in internal ward.

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